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OIL CIRCULATING SYSTEM FOR ROTARY FLUID COMPRESSORS

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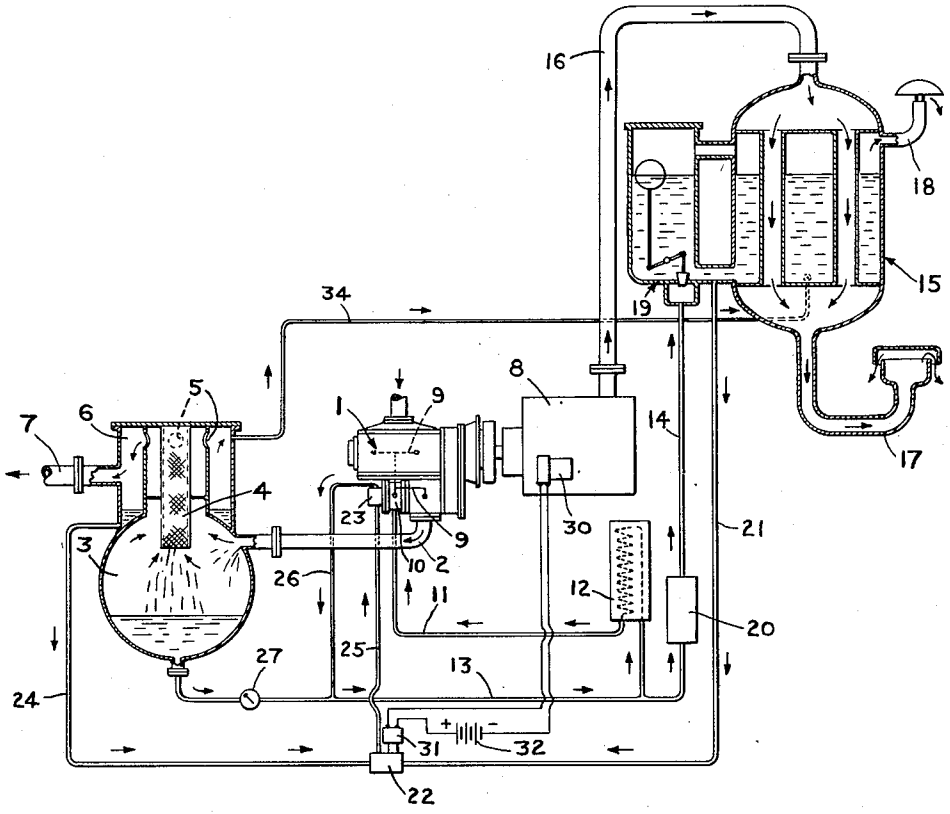

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OIL CIRCULATING SYSTEM FOR ROTARY FLUID COMPRESSORS

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This invention relates to rotary compressors for compressing various fluids, preferably air and, more particularly, to that type of rotary compressor wherein lubricating oil is delivered into the compressing chambers and serves to lubricate the moving parts of the compressor as well as to cool the compressed fluid. The oil is discharged with the compressed fluid and separated therefrom prior to delivery of the compressed fluid to the point of use.

The present invention relates to the combination of such a compressor having means for separating oil and air, means for boiling contained water from the oil, which later is picked up by the oil due to condensation of moisture content of the air during compression. The present invention also embodies the returning of the purified oil to the compressor at predetermined intervals during operation of the compressor and an arrangement whereby predetermined quantities of the oil are by-passed from the main oil flow path to a suitable boiler or heat exchange apparatus in which heat is supplied by the exhaust of the engine driving the compressor and means for timing the return of the oil from the waste heat boiler back into the normal flow path of oil in the system.

With these and other objects in view, as may appear from the accompanying specification, the invention consists of various features of construction and combination of parts, which will be first described in connection with the accompanying drawing, showing a diagrammatic view partly in elevation and partly in vertical section of an oil circulating system for rotary fluid compressors of a preferred form embodying the invention, and the features forming the invention will be specifically pointed out in the claims.

Referring more particularly to the drawing, 1 indicates a rotary compressor of the type embodying rotating impeller or impellers operating to compress air or other fluids which embodies means for delivering lubricating oil not only to the bearings of the compressor but directly into the compressing chamber or chambers where the oil is mixed with the air or fluid being compressed and is discharged through the discharge outlet 2 of the compressor into a suitable receiver 3.

One such type of compressor is shown in application Serial No. 350,091, filed April 21, 1953. The mixed compressed air or fluid and the oil is delivered under the discharge pressure of the rotary compressor 1 into the receiver 3 and passes outwardly from the receiver through a separator 4 which is carried by and extends into the receiver. The oil separator 4 may be of any approved construction which may be purchased upon the open market and it will separate the greater portion of the oil from the air allowing the oil to fall and collect in the lower part of the receiver 3 while the air passes outwardly through the outlet openings 5 into the secondary receiver 6 where considerable of the residual oil will separate from the air and through which the air will pass through the outlet 7 to the point of use. The residual oil separated from the air in the secondary oil reservoir 6 falls to the bottom thereof, as clearly shown in the drawings.

The rotary compressor 1 is shown as driven by an internal combustion engine 8 of any approved type and oil is delivered to the interior of the rotary compressor through suitable oil conduits indicated at 9 in the drawing under pressure developed by a rotary pump 10 operated by the rotary compressor. The suction or inlet of the rotary pump 10 receives lubricating oil from an oil line 11 which is connected to the outlet side of an oil cooler 12. The oil cooler 12 may be of any approved construction suitable for the purpose and which may be purchased upon the open market. Oil is delivered to the oil cooler 12 by an oil line 13 which is connected to the lower portion of the receiver 3 so that the oil, which is under pressure in the receiver 3 due to the fact that it is subjected to the discharge pressure of the rotary compressor 1, will be forced through the oil line 13 into and through the cooler 12 and back to the suction of the rotary pump 10.

Varying degrees of humidity in the air being compressed will result in various quantities of water being condensed out of the compressed air or fluid which condensation in the form of water accumulates in the oil, and to maintain the oil in proper condition for proper lubrication of the rotary compressor 1 it is necessary to remove such water or condensation from the oil. For this purpose a branch line 14 is connected to the oil line 13 so that during the normal flow of the oil from the receiver to the rotary compressor and back to the receiver a predetermined relatively small quantity of the oil will be, in effect, by-passed through the auxiliary line 14 to a waste heat boiler 15 wherein the mixed oil and water are subjected to heat for vaporizing the water and causing it to pass out of the waste heat boiler in the form of steam while the oil is retained in the waste heat boiler for return under suitable control to the main oil flow path of the system.

The waste heat boiler may be of any suitable construction of heat exchange apparatus and it receives its heating medium in the form of the exhaust from the engine 8 which operates the rotary compressor 1. The exhaust from the engine 8 passes to the waste heat boiler 15 through a suitable conduit 16 where it passes in non-contact heat exchange relationship with the oil and water to cause conversion of the water into steam or vapor. After passing through the waste heat boiler the exhaust gases from the engine 8 are exhausted to atmosphere through a suitable exhaust mechanism 17. The vaporized water also exhausts to atmosphere through a suitable outlet 18.

A float valve construction 19 of any approved construction is employed for controlling the quantity of oil delivered into the waste heat boiler 15 so that when the oil and water in the waste heat boiler reaches a predetermined level therein the float valve will close preventing the passage of further oil and water into the waste heat boiler. However, when the level of oil and water in the boiler falls below the predetermined level the float valve will open to admit more oil and water to the waste heat boiler. If it is so desired, an oil filter of any approved type such as indicated at 20 may be interposed in the line 14.

The oil, after the water has been boiled therefrom is returned to the normal oil flow path in the system under time control through a suitable oil line 21. A three-way solenoid operated valve 22 of any approved type which may be purchased upon the open market is connected in the oil line 21. This oil line 21 opens into one of the ports of the three-way valve and discharges through another port thereof (not shown) to the suction of a second rotary pump which we will call the scavenger pump 23. The scavenger pump 23 may be mounted upon and operated by the same shaft or mechanism as the oil delivery rotary pump 10 although it has no fluid passage connection with the rotary oil delivery pump 10. An oil line 24 is connected to the lower portion of the secondary receiver 6 so that oil which collects in the receiver 6 will flow into the line 24. The line 24 is connected to another of the ports (not shown) in the three-way valve 22 so that when the three-way valve 22 is positioned in one position oil will be drawn from the secondary reservoir 6 through the three-way valve 22 and line 25 into the suction of the scavenging pump 23. This oil will be discharged from the scavenging pump 23 through the line 26 back into the line 13 where it will mix with the oil from the receiver 3 passing through the air cooler 12. During the time the scavenging pump 23 is withdrawing the oil from the auxiliary or secondary receiver 6 the valve 22 will be in position to prevent oil from the waste heat boiler passing through the three-way valve 22 to the scavenging pump 23. A check valve 27 is interposed in the line 13 between the receiver 3 and the connection of the line 26 with the line 13 to prevent backflow of oil from the scavenging pump into the receiver 3.

A timer counter 30, which may be of any approved

construction which may be purchased upon the open market, is connected in an electrical circuit with the solenoid **31** of the three-way valve **22** and with a suitable source of electric energy such as a battery or generator indicated at **32**. This timer is so set that the engine **8** and rotary compressor **1** will run for a predetermined number of revolutions after which energization of the solenoid **31** will be actuated to operate the three-way valve **22** to drain the purified water-free oil from the waste heat boiler **15** back through the scavenging pump **23** and into the line **13**. This operation is timed for a predetermined period of time or number of revolutions of the compressor, say for instance, a time interval of five minutes, or 9,000 revolutions, after which the timer **30** deenergizes the solenoid **31** to operate the valve **22** and cut off the flow of oil from the waste heat boiler **15** to the scavenging pump. At the same time that the flow of oil from the waste heat boiler **15** to the scavenging pump **23** is cut off the valve **22** will open the line **24** so as to permit oil to be drained from the secondary receiver **6** by the scavenging pump and returned to the system.

An air line **34** is shown connected in the secondary receiver **6** to the waste heat boiler for passing a small amount of pressure air into the oil in the waste heat boiler for agitating the oil and facilitating the vaporization of the water content.

It will be understood that the invention is not to be limited to the specific construction or arrangement of parts shown, but that they may be widely modified within the invention defined by the claims.

What is claimed is:

1. In an oil circulating system for rotary compressors, the combination with a rotary compressor having a discharge for compressed fluid, means for delivering lubricating oil into said compressor where it mingles with and is discharged with the compressed fluid, a receiver tank receiving the discharged compressed fluid from the compressor, a fluid and oil separator connected to said tank whereby compressed fluid passing through its point of use will pass through said separator, means for returning oil from said receiver tank to said compressor, a waste heat boiler, means for delivering part of the oil from said receiver tank to said waste heat boiler, means for delivering oil from said waste heat boiler to said rotary compressor, valve means normally preventing delivery of oil from said waste heat boiler to the compressor, and means for operating said valve means at predetermined intervals to permit delivery of oil from said waste heat boiler to the compressor.

2. An oil circulating system for rotary compressors as claimed in claim 1 including a secondary receiver for receiving the compressed fluid and residual oil from said separator, means including said valve means for delivering residual oil from said secondary receiver to the compressor, said valve means constructed and arranged whereby when oil is delivered to the compressor from said waste heat boiler delivery of oil from said secondary receiver will be cut off.

3. An oil circulating system for rotary compressors as claimed in claim 1 including means for delivering a limited quantity of compressed fluid into said waste heat boiler to provide agitation of the oil therein.

4. An oil circulating system for rotary compressors as claimed in claim 1 including a secondary receiver for receiving the compressed fluid and residual oil from said separator, means including said valve means for delivering residual oil from said secondary receiver to the compressor, said valve means constructed and arranged whereby when oil is delivered to the compressor from said waste heat boiler delivery of oil from said secondary receiver will be cut off, and means for delivering a limited quantity of compressed fluid from said secondary receiver into said waste heat boiler to provide agitation of oil therein.

5. In an oil circulating system for rotary compressors, a combination with a rotary compressor having a discharge for compressed fluid, means for delivering lubricating oil into said compressor where it mingles with and is discharged with the compressed fluid, a receiver tank receiving the discharged compressed fluid from the compressor, a fluid and oil separator connected to said tank whereby compressed fluid passing through its point of use will pass through said separator, means for returning oil from said receiver tank to said compressor, including an oil delivery conduit, a waste heat boiler, a secondary conduit connection between said oil delivery conduit and

waste heat boiler for delivering a limited quantity of oil to the waste heat boiler, a secondary receiver for receiving compressed fluid and residual oil from said oil separator, a conduit connecting said secondary receiver and waste heat boiler for delivering oil to the compressor valve means in said secondary conduit, and means operated during operation of said compressor for operating said valve to alternately force delivery of oil from the waste heat boiler and said secondary receiver to the compressor.

6. In an oil circulating system for rotary compressors, a combination with a rotary compressor having a discharge for compressed fluid, means for delivering lubricating oil into said compressor where it mingles with and is discharged with the compressed fluid, a receiver tank receiving the discharged compressed fluid from the compressor, a fluid and oil separator connected to said tank whereby compressed fluid passing through its point of use will pass through said separator, means for returning oil from said receiver tank to said compressor, including an oil delivery conduit, a waste heat boiler, a secondary conduit connection between said oil delivery conduit and waste heat boiler for delivering a limited quantity of oil to the waste heat boiler, a secondary receiver for receiving compressed fluid and residual oil from said oil separator, a conduit connecting said secondary receiver and waste heat boiler for delivering oil to the compressor valve means in said secondary conduit, automatically timed means operable during operation of the compressor to operate said valve means for predetermined periods of time at predetermined time intervals to allow delivery of oil from said waste heat boiler to the compressor and cut off delivery of oil from the secondary receiver to the compressor.

7. In an oil circulating system for rotary compressors, a combination with a rotary compressor having a discharge for compressed fluid, means for delivering lubricating oil into said compressor where it mingles with and is discharged with the compressed fluid, a receiver tank receiving the discharged compressed fluid from the compressor, a fluid and oil separator connected to said tank whereby compressed fluid passing through its point of use will pass through said separator, means for returning oil from said receiver tank to said compressor, including an oil delivery conduit, a waste heat boiler, a secondary conduit connection between said oil delivery conduit and waste heat boiler for delivering a limited quantity of oil to the waste heat boiler, a secondary receiver for receiving compressed fluid and residual oil from said oil separator, a conduit connecting said secondary receiver and waste heat boiler for delivering oil to the compressor valve means in said secondary conduit, and means for delivering a limited quantity of compressed fluid into said waste heat boiler to provide agitation of oil therein.

8. In an oil circulating system for rotary compressors, a combination with a rotary compressor having a discharge for compressed fluid, means for delivering lubricating oil into said compressor where it mingles with and is discharged with the compressed fluid, a receiver tank receiving the discharged compressed fluid from the compressor, a fluid and oil separator connected to said tank whereby compressed fluid passing through its point of use will pass through said separator, means for returning oil from said receiver tank to said compressor, including an oil delivery conduit, a waste heat boiler, a secondary conduit connection between said oil delivery conduit and waste heat boiler for delivering a limited quantity of oil to the waste heat boiler, a secondary receiver for receiving compressed fluid and residual oil from said oil separator, a conduit connecting said secondary receiver and waste heat boiler for delivering oil to the compressor valve means in said secondary conduit, and means operated during operation of said compressor for operating said valve to alternately force delivery of oil from the waste heat boiler and said secondary receiver to the compressor, a scavenging pump having its inlet connected to said valve and its discharge connected to said oil delivery conduit whereby oil from either the waste heat boiler or the secondary receiver will be delivered into said oil delivery conduit for delivery to said compressor.

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